

Description

[0001] This invention relates to a magazine for an air-gun. In particular, it relates to an airgun magazine having a plurality of chambers for receiving airgun pellets. The invention also relates to a magazine rotor and a method of manufacturing an airgun magazine.

[0002] Air guns use a charge of pressurised gas to propel a pellet out of the gun and towards a target. The pressurised gas may be provided by a bottle of pre-pressurised gas or by a spring that compresses the gas each time a lever is actuated by the user. Single-shot air guns require a pellet to be manually loaded into the gun each time the gun is fired. Thus, the user typically places the pellet directly into the breech of the air gun or places it on a loading track and pushes the pellet into the breech using a bolt. Multi-shot air guns utilise a magazine, which stores a plurality of pellets. The magazine automatically presents each of the pellets to the breech in turn so that they can be loaded into the breech. This is typically performed using a bolt which is moved from a withdrawn position to a forward position. The bolt is adapted to contact the tail of the pellet pushing it into the breech. The bolt, in the forward position, closes the rear of the breech so that the pellet can be propelled out of the barrel by the influx of expanding compressed air which enters the breech behind the pellet.

[0003] A known airgun magazine is described in EP 0 341 090. The magazine comprises a circular pellet carrier that is rotatably mounted in an outer case and a cover that is pivotally mounted on the outer case. A spring biases the pellet carrier towards an end position. To load the magazine, the cover is pivoted to cause the pellet carrier to rotate to another end position, and a pellet is then dropped into a pellet chamber in the pellet carrier. The outer cover is rotated to allow successive pellets to be dropped into successive pellet chambers within the pellet carrier. In use, a probe pushes the first pellet out of the magazine into the breech of an airgun. The probe is retracted, and following this, the magazine automatically indexes under spring pressure to present the next pellet ready for loading. The pellets themselves serve as part of the indexing mechanism.

[0004] According to a first aspect of the invention, we provide a magazine for an airgun comprising a housing and a magazine rotor rotatably mounted therein, the magazine rotor including a plurality of bores therethrough, each bore forming a chamber for receiving an airgun pellet, the magazine further including an indexing arrangement including a biasing element to index the magazine rotor, wherein at least one of the bores includes a lead-in portion adapted and arranged such that when contacted by a bolt of an airgun when the magazine is mounted in an airgun, the magazine rotor is rotated against the force of the biasing element.

[0005] This is advantageous as the lead-in portion ensures that the magazine rotor is aligned to enable clear passage of the pellet out of the chamber of the magazine

and into the breech of the airgun. Thus, the biasing element will act to index the chamber to a loading position, while the lead-in portion will provide the means for fine adjustment of the loading position to allow the pellet to pass into the breech with the minimum of hindrance from the magazine. This will prevent damage or denting of the pellet as it is moved out of the chamber.

[0006] Preferably the lead-in portion extends over only a portion of a rim of the at least one bore. Thus, the lead-in portion is located on one side of the bore or chamber towards the subsequent chamber on the magazine rotor.

[0007] Preferably, the lead-in portion comprises a chamfer on a rim of the bore. This is advantageous as a chamfer is relatively easy to apply during manufacture. Preferably, the chamfer is offset with respect to the bore. This is advantageous as an offset chamfer presents a larger contact region to a bolt. Thus, the contact region of the chamfer is offset to a side of the bore that enables the magazine rotor to be rotated by the bolt against the force of the biasing element.

[0008] The chamfer may be offset from the bore by between 0.5 and 5° with respect to the magazine rotor. Preferably it is offset by between 2 and 3° with respect to the magazine rotor.

[0009] Preferably, the indexing arrangement further includes an abutment post for indexing the at least one chamber with the breech in combination with the biasing element when in use. Preferably the abutment post is arranged to abut a pellet located in the chamber to index that pellet with the breech of the airgun when in use. Preferably the abutment post arranged to project from the housing toward the magazine rotor, the magazine rotor including a track therethrough such that the abutment post can pass through each chamber of the magazine rotor when it is rotated, the abutment post providing a stop which prevents rotation of the magazine rotor under the force of the biasing element when a pellet is present in the chamber. Thus, the indexing of the magazine is provided by the abutment post bearing against the pellet in the chamber, which is loaded against the peg by the action of the biasing element. When the pellet is removed from the magazine, such as when it is moved to the breech ready for propelling from the gun, the magazine rotor can rotate further until the abutment post contacts a further pellet in a subsequent chamber. It will be appreciated that the track in which the abutment post passes is smaller than a pellet.

[0010] Accordingly, the lead-in portion is arranged such that magazine rotor will be rotated against the force of the biasing element by a bolt an amount to reduce or remove the force on the pellet that loads it against the abutment post, so that the pellet can be moved out of the chamber of the magazine rotor. This is advantageous as the pellet can be damaged if it is pushed out of the magazine while loaded against the abutment post by an opposed side of the chamber under the force of the biasing element.

[0011] Preferably the housing is at least partly of self-

lubricating plastics.

[0012] Preferably the housing includes a plate having a magazine loading aperture therein through which pellets are passed when loading the at least one chamber with a pellet, the plate having a thickness of less than 1mm. Preferably the plate has a thickness of substantially 0.5mm. Preferably the plate is of metal. This is advantageous as the thin metal plate ensures that the magazine is robust while making it easy for a user to push each pellet through the aperture and into the chamber. As the plate is thin, a user is able to push the pellet completely through the aperture with their finger so that it is wholly within the chamber, which would be difficult with a thicker plate.

[0013] According to a second aspect of the invention we provide a magazine rotor comprising a body having a plurality of bores therethrough, each bore forming a chamber for receiving an airgun pellet, wherein at least one of the bores includes a lead-in portion extending partially around the rim of the bore.

[0014] Preferably the lead-in portion comprises a chamfer on the rim of the bore.

[0015] Preferably the chamfer is larger on one side of the bore than an opposite side of the bore.

[0016] According to a third aspect of the invention we provide method of manufacturing a magazine for an airgun, including the steps of;
applying a chamfer to a bore that forms a chamber for receiving an airgun pellet in a magazine rotor, wherein the chamfer is larger on one side of the bore than an opposite side of the bore.

[0017] Preferably the step of applying a chamfer is performed by applying a countersink to the bore, wherein the method includes the step of offsetting the centre of the countersink with respect to the centre of the bore to which the countersink is to be applied.

[0018] According to a fourth aspect of the invention, we provide a magazine for an airgun comprising a housing and a magazine rotor rotatably mounted therein, the magazine rotor including a plurality of bores therethrough, each bore forming a chamber for receiving an airgun pellet, wherein at least one of the chambers includes a resilient member for retaining a pellet in the chamber.

[0019] This is advantageous as the resilient member can firmly hold a pellet in the chamber without damaging it. Further, as the member is resilient, it can be deformed out of the way when it is necessary to push the pellet into or out of the chamber.

[0020] Preferably each chamber comprises an internal wall, a first open end and an opposed second open end, wherein the resilient member extends from the internal wall into the chamber.

[0021] Preferably, the internal wall includes an aperture therein adapted to receive the resilient member therethrough.

[0022] Preferably the magazine rotor includes an annular groove, the annular groove extending partially into

each chamber, wherein the resilient member comprises a resilient ring mounted in the annular groove. Preferably the resilient ring comprises an O-ring. Thus, resilient ring comprises a single element that partially extends into each chamber through a slot formed by the annular groove. As the ring is resilient it will deform when pressure is applied and it will also move out of the slot thereby providing sufficient force to retain a pellet in the chamber while not significantly hindering passage of the pellet into or out of the chamber.

[0023] The resilient member of the fourth aspect of the invention and its optional features may form optional features of the first aspect of the invention. Likewise, the lead-in portion of the first aspect of the invention and its associated optional features can comprise optional features of the fourth aspect of the invention.

[0024] According to a fifth aspect of the invention, we provide a magazine for an airgun comprising a housing and a magazine rotor rotatably mounted therein, the magazine rotor including a plurality of bores therethrough, each bore forming a chamber for receiving an airgun pellet, wherein the housing includes a plate having a magazine loading aperture therein through which pellets are passed when loading each of the chambers with a pellet, the plate having a thickness of less than 1mm.

[0025] This is advantageous as the thin metal plate ensures that the magazine is robust while making it easy for a user to push each pellet through the aperture and into the chamber. As the plate is thin, a user is able to push the pellet completely through the aperture with their finger so that it is wholly within the chamber, which would be difficult with a thicker plate.

[0026] Preferably the plate has a thickness of substantially 0.5mm. Preferably the plate is of metal.

[0027] According to a sixth aspect of the invention, we provide an airgun arranged to receive the magazine of the first aspect of the invention, wherein a bolt of the airgun is arranged to contact the lead-in portion of the at least one bore to rotate the magazine rotor against the force of the biasing element.

[0028] This is advantageous as the cooperation between the lead-in portion and the bolt ensures that the bore is aligned with the breech of the airgun to ensure that the pellet can move out of the chamber without being damaged.

[0029] There now follows by way of example only a detailed description of the present invention with reference to the accompanying drawings, in which;

Figure 1 shows and exploded perspective view of an embodiment of a magazine in accordance with the invention;

Figure 2 shows an opposite side of the magazine rotor shown in Figure 1;

Figure 3 shows a close up view of the chambers of the magazine rotor including the lead-in portion;

Figure 4 shows a side view of the magazine rotor shown in the preceding Figures; and

Figure 5 shows a flow chart illustrating the method of manufacture of the magazine.

[0030] The magazine 1 shown in Figure 1 is for use in a multi-shot airgun and, in particular, an air rifle. The magazine 1 can be loaded with pellets and then placed in an airgun between a breech and a bolt of the airgun. The bolt is typically slidably mounted in the airgun and includes a distal portion having a seal thereon. The bolt of the airgun is typically arranged to slide between a withdrawn position and a forward position. When the magazine is mounted in the airgun and the bolt is adapted to be moved from the withdrawn position to the forward position to load a pellet into the breech of the airgun. Thus, the bolt moves through the magazine, contacting and pushing a pellet as it goes into the breech. The distal portion of the bolt also enters the breech and the seal closes the rear of the breech. This airgun can now be fired. Once fired, the bolt can be moved from its forward position to its withdrawn position thereby sliding out of the magazine 1.

[0031] The magazine 1 comprises a housing 2 and a magazine rotor 3. The magazine rotor is arranged to be rotatably mounted within the housing 2. Accordingly, the housing 2 includes a boss 4 and the magazine rotor 3 includes a mounting aperture 5. The aperture 5 is arranged to receive the boss 4 therein thus forming a pivot. The housing 2 further includes a plate 6 that retains the magazine rotor 3 therein.

[0032] The magazine rotor 3 includes a plurality of cylindrical bores extending therethrough in an axial direction that form chambers 7, each chamber arranged to receive an airgun pellet. The chambers 7 are arranged in a circular configuration around the pivot of the magazine rotor 3. Each chamber has a cylindrical wall and two opposed open ends. Each chamber 7 includes a lead-in portion 8 that is arranged to be contacted by a bolt of the airgun in which the magazine is mounted, when the bolt is moved from its withdrawn position to its forward position.

[0033] The housing 2 includes an abutment post 10 that projects from an internal surface of the housing 2 and is arranged to extend into the magazine rotor 3, when the rotor is mounted on the boss 4. The abutment post 10 is received within an annular track 11 (shown in Figure 2). The annular track 11 is narrower in width than the diameter of each of the chambers 7. The track 11 extends through a portion of each of the chambers 7, wherein the track 11 has a depth less than the depth of the chambers 7. The housing 2 further includes an aperture 12 adjacent the abutment post 10. The aperture 12 will be referred to hereinafter as the "transfer aperture" as it is the aperture through which pellets pass when they are transferred from the magazine to the breech of the airgun.

[0034] The housing 2 includes side walls 13 that in-

clude alignment pegs 14 at their free end. The alignment pegs 14 are complementary to alignment apertures 15 in the plate 6 and are adapted to be received therein when the plate 6 is fastened to the housing 2. The plate 6 thus includes a securing aperture 16 for receiving a screw that secures the plate 6 to the remainder of the housing 2 using the boss 4. The plate 6 further includes a magazine loading aperture 17 that is aligned with the aperture 12. Each of the chambers 7 can be brought into alignment with both the magazine loading aperture 17 and aperture 12 when the magazine rotor 3 is rotated. The housing 2 further includes openings 18 which provide access to the side of the magazine rotor 3.

[0035] The magazine rotor 3 is also arranged to receive a biasing element comprising a coil spring (not visible) that urges the magazine rotor 3 to rotate to a first position. The magazine rotor 3 can be rotated to a second position against the force of the biasing element. The first and second positions are defined by the ends of an open circular groove 20 which cooperates with a rod (not visible) that extends from the plate 6. The groove 18 and rod thus limit the rotational movement of the magazine rotor 3.

[0036] Figure 3 shows a close up view of part of the magazine rotor 3 in which two chambers 7 are visible. Each chamber 7 includes a lead-in portion 8 which comprises a chamfer on a rim 30 of the chamber 7. The chamfer 8 is offset from the centre of the chamber 7 towards the subsequent chamber 7. Thus, the chamfer 8 extends over a portion of the rim of the chamber on one side. Figure 3 shows the chamber 7 having a further chamfer 31 on an opposite side to the chamfer 8, however, the further chamfer 31 is centred with the chamber 7. The centre point of the chamber 7 is shown by cross A. The centre point of the chamfer 8 is shown by cross B. The centres A of each of the chambers 7 lie on a circular path and the centre B of the chamfer 8 of each chamber 7 is offset from the centre A along the circular path in the circumferential direction. The angle formed at the centre of the magazine rotor 3 between the centre A and centre B is represented by α and in this embodiment is substantially 2.5° .

[0037] Figure 3 also shows the first end 32 and second end 33 of the groove 20, which in cooperation with the rod define the first and second positions.

[0038] Figure 4 shows a side view of the magazine rotor 3. The magazine rotor 3 includes an annular groove 40 that extends radially into the magazine rotor 3. The annular groove 40 has a depth such that it extends partially into each chamber 7. Thus, a plurality of slots 41 are formed at the base of the groove 40 that provide access to the chambers 7. The groove 40 is arranged to receive an O-ring 42 therein. The O-ring is of a resilient deformable material, such as rubber or plastics. The O-ring is wholly received within the groove and portions of the O-ring will extend through each of the slots 41 and thus into each of the chambers 7. The dashed lines 43 in Figure 3 show the O-ring 42 projecting into each of the

chambers 7. The O-ring is adapted to provide means to retain a pellet in the chamber 7. Typically a pellet comprises a domed or pointed head, a tapered waist of smaller diameter and then a flared tail portion of similar diameter to the head portion. The O-ring is positioned such that it will contact the waist of the pellet when the pellet is fully inserted into the chamber 7 to hold the pellet therein.

[0039] In use, the user will typically load the magazine with pellets, insert the magazine in the airgun then shoot each of the pellets until the magazine while the magazine 1 automatically presents the next pellet to the breech for loading into the breech.

[0040] Without any pellets loaded into the magazine 1, the magazine rotor 3 adopts the first position under the influence of the biasing element. Thus, the rod abuts the first end 32 of the groove 20. In the first position, one of the chambers 7, which we will designate the tenth chamber 7j, is substantially aligned with the magazine loading aperture 17 (and also the transfer aperture 12). A pellet can then be pressed through the magazine loading aperture 17 and into the tenth chamber 7j. As the plate 6 is thin, it is easy for a user to press the pellet such that it is loaded into the chamber 7j and does not extend into the magazine loading aperture 17. As the pellet is inserted into the chamber 7j the head portion will deflect and/or deform the O-ring radially outwardly. Once the head portion has past the O-ring 42, the O-ring will resile such that it contacts the waist of the pellet. The O-ring will therefore hold the pellet in the chamber 7j.

[0041] The user rotates the magazine rotor 3 with their fingers through the openings 18 in a counter-clockwise direction as shown in Figure 1 against the force of the biasing element until the adjacent ninth chamber 7i is aligned with the magazine loading aperture 17. A further pellet can then be inserted into the ninth aperture 7i, which is held therein by the O-ring as described above. Once the pellet is inserted in to the ninth aperture 7i, the magazine rotor is held in its position by the abutment post 10. In particular, the biasing element attempts to return the magazine rotor 3 to the first position. However, the presence of the pellet in the chamber 7i prevents the abutment post 10 from moving along its track 11 through the ninth chamber 7i. Accordingly, the pellet in the ninth chamber will be held against the abutment post 10 by the opposing wall of the ninth chamber, which is biased by the biasing element.

[0042] The user then rotates the magazine rotor 3 further in a counter-clockwise direction against the force of the biasing element until the adjacent eighth chamber 7h is aligned with the magazine loading aperture 17. The same procedure is repeated until the first chamber 7a has been loaded with a pellet. Once the first chamber 7a has been loaded with a pellet, the magazine rotor is in its first position and the rod is located substantially at the second end 33. It will be appreciated that all of the chambers do not need to be loaded with a pellet but as it is the presence of a pellet in a chamber that prevents the

magazine rotor "unwinding" past that chamber, the chambers must be loaded from the tenth to the first.

[0043] The magazine 1 can then be removably mounted into an airgun. If the magazine is fully loaded, the first chamber 7a will be substantially aligned with the magazine loading aperture 17 and transfer aperture 12. Due to the arrangement of the indexing means, the biasing element will load the first pellet in the chamber 7a against the abutment post 10. To load the first pellet into the breech of the gun from the magazine 1, a bolt is moved from a withdrawn position to a forward position. The bolt comprises an elongate probe that first passes through the magazine loading aperture 17. The bolt will then contact the lead-in portion 8 of the first chamber 7a. As the lead-in portion provides an inclined surface into the bore that forms the chamber 7a, forward motion of the bolt will rotate the magazine rotor 3 against the force of the biasing element (counter clockwise in this example). This small rotation as the bolt moves forward will release the force on the pellet that "pinches" it between the abutment post 10 and the opposed wall of the chamber 7a. The bolt then contacts the pellet and moves it towards the transfer aperture 12. The release of this force prevents the pellet being damaged as it is pushed by continued movement of the bolt through chamber 7a and the transfer aperture 12. The O-ring 42 will be moved radially outwardly and/or deformed over the tail portion of the pellet as it is moved out of the chamber 7a. The O-ring is adapted to only apply a force sufficient to gently hold the pellet and therefore it does not damage or significantly hinder the pellet when it is pushed through. The bolt then reaches the forward position, in which it is extending through the magazine 3 and forms the rear of the breech. The pellet can then be propelled from the airgun.

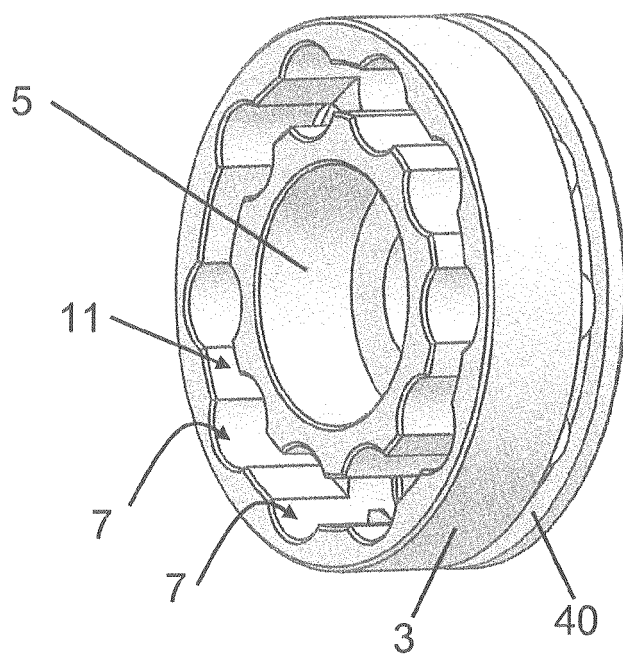
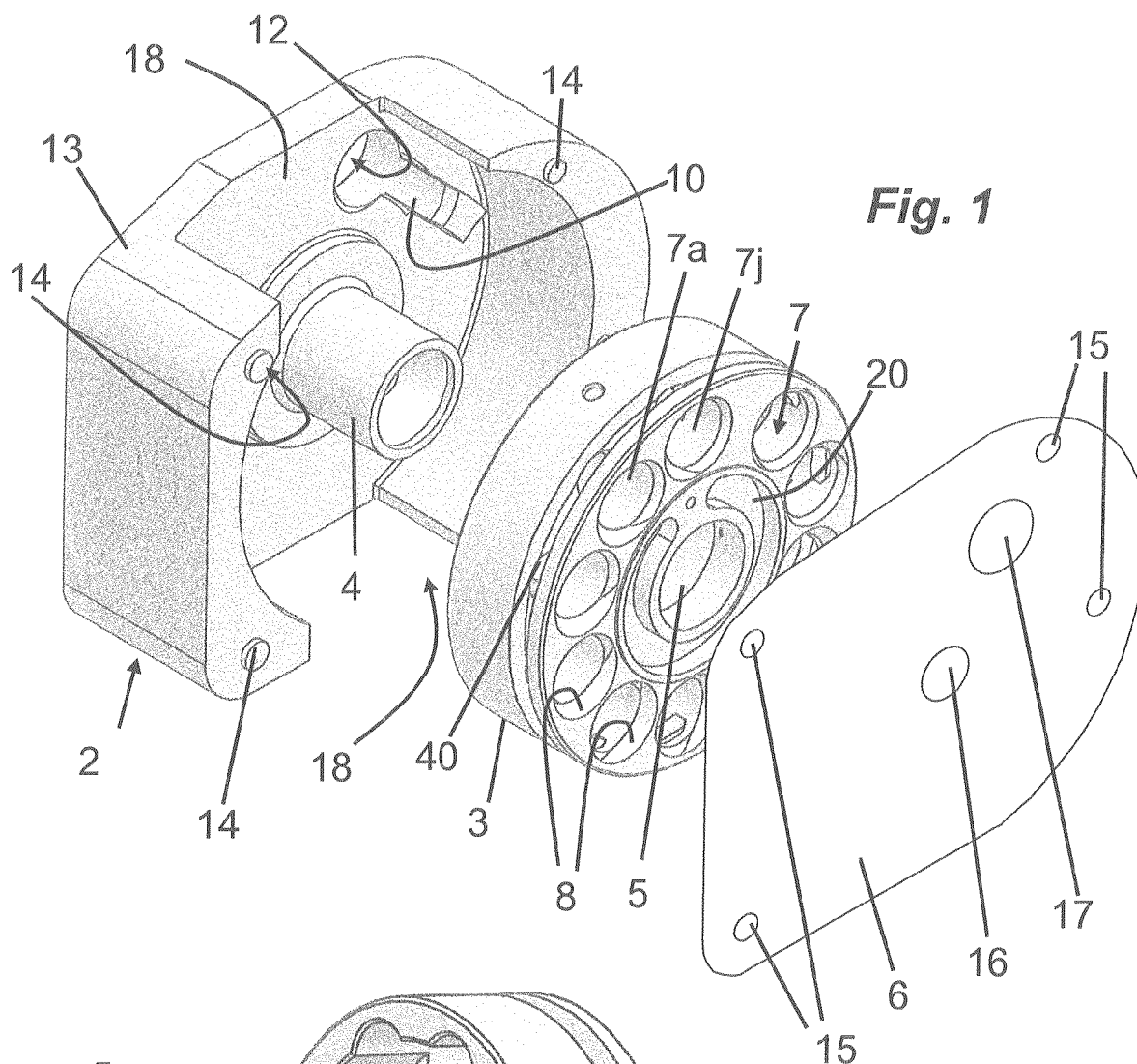
[0044] The bolt can then be withdrawn to its withdrawn position. As the bolt is withdrawn from the first chamber 7a, the biasing element can rotate the magazine rotor 3 until the abutment post contacts the pellet loaded into the second chamber 7b. The bolt can then be moved forward to load the second pellet from the second chamber into the breech. The process can then continue as described above until all of the chambers 7a-i are empty.

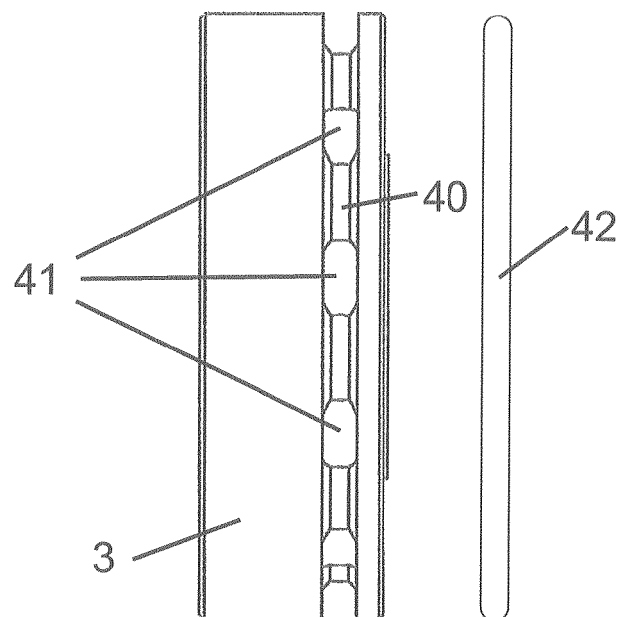
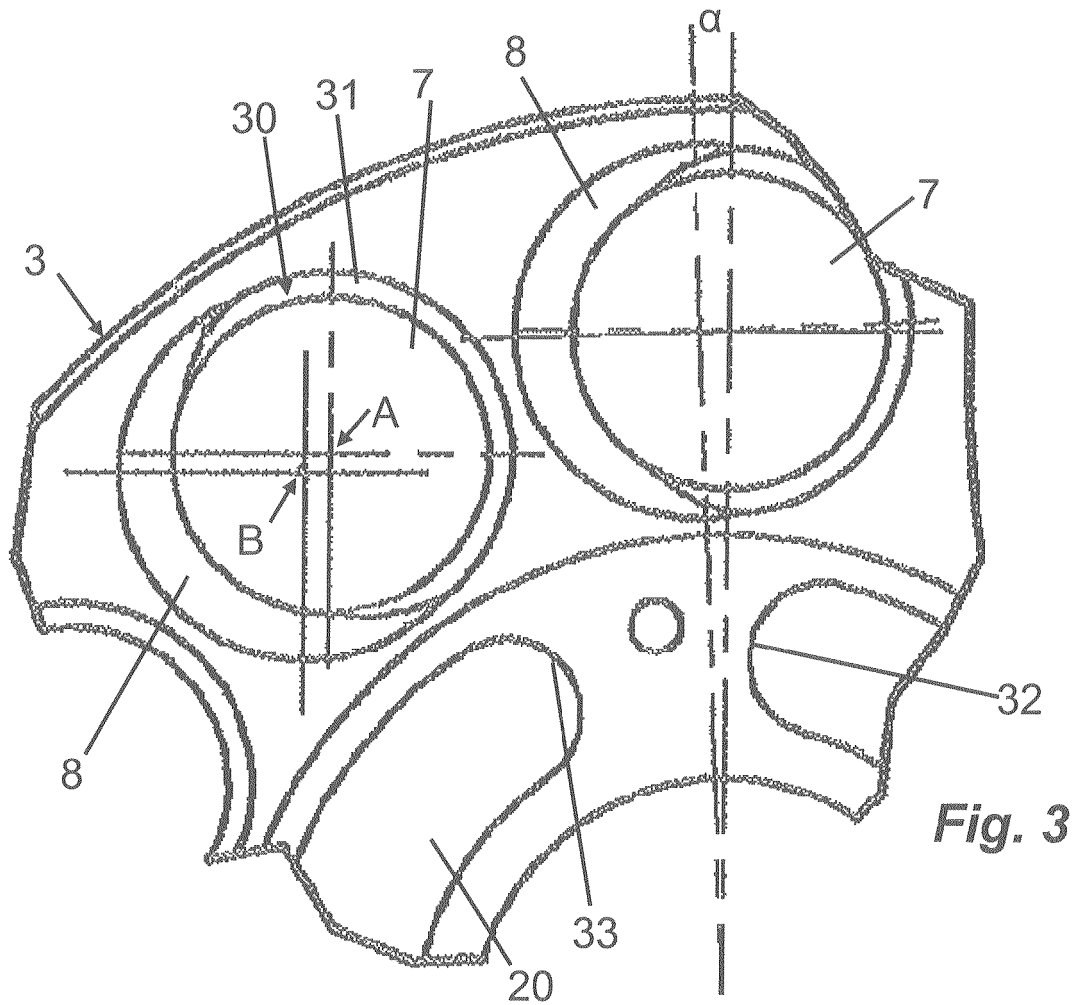
[0045] Figure 6 shows a flow chart illustrating the method of manufacture of the magazine rotor 3. Step 50 shows receiving a magazine rotor having a plurality of bores formed therein for receiving airgun pellets. Step 51 comprises identifying the centre of one of the bores. Step 52 comprises locating a chamfering tool, which typically comprises a countersink, offset from the centre of the bore. Step 53 comprises applying a chamfer to the bore wherein the chamfer is larger on one side of the bore than an opposite side of the bore due to the offset chamfering tool.

Claims

1. A magazine for an airgun comprising a housing (2)

- and a magazine rotor (3) rotatably mounted therein, the magazine rotor (3) including a plurality of bores (7) therethrough, each bore forming a chamber (7) for receiving an airgun pellet, the magazine (1) further including an indexing arrangement including a biasing element to index the magazine rotor (3), wherein at least one of the bores (7) includes a lead-in portion (8) adapted and arranged such that when contacted by a bolt of an airgun when the magazine (1) is mounted in an airgun, the magazine rotor (3) is rotated against the force of the biasing element.
2. A magazine according to claim 1, in which the lead-in portion (8) extends over only a portion of a rim (30) of the at least one bore (7).
 3. A magazine according to claim 1 or claim 2, in which the lead-in (8) portion comprises a chamfer on a rim (30) of the bore (7).
 4. A magazine according to claim 3, in which the chamfer (8) is offset with respect to the bore (7).
 5. A magazine according to claim 4, in which the chamfer (8) is offset from the bore by between 0.5 and 5° with respect to the magazine rotor (3) and preferably by between 2 and 3° with respect to the magazine rotor (3).
 6. A magazine according to any preceding claim, in which the indexing arrangement further includes an abutment post (10) for indexing the at least one chamber (7) with the breech in combination with the biasing element when in use.
 7. A magazine according to claim 6, in which the abutment post (10) is arranged to abut a pellet located in the chamber (7) to index that pellet with the breech of the airgun when in use.
 8. A magazine according to claim 6 or claim 7, in which the abutment post (10) arranged to project from the housing (2) toward the magazine rotor (3), the magazine rotor including a track (11) therethrough such that the abutment post (10) can pass through each chamber (7) of the magazine rotor (3) when it is rotated, the abutment post (10) providing a stop which prevents rotation of the magazine rotor (3) under the force of the biasing element when a pellet is present in the chamber.
 9. A magazine rotor comprising a body having a plurality of bores (7) therethrough, each bore forming a chamber for receiving an airgun pellet, wherein at least one of the bores includes a lead-in portion (8) adapted and arranged such that when mounted within a magazine (1) in an airgun and contacted by a bolt of an airgun, the magazine rotor (3) is rotated.
 10. A magazine rotor according to claim 9, in which the lead-in portion (8) comprises a chamfer on the rim (30) of the bore (7), which is preferably larger on one side of the bore than an opposite side of the bore.
 11. A method of manufacturing a magazine for an airgun, including the steps of; applying a lead-in portion (8) to a bore (7) that forms a chamber for receiving an airgun pellet in a magazine rotor (3), wherein the lead-in portion is adapted and arranged such that when in use in an airgun and contacted by a bolt of the airgun, the magazine rotor is rotated.
 12. A method according to claim 11, in which the step of applying a lead-in portion is performed by applying a countersink to the bore, wherein the method may include the step of offsetting the centre of the countersink with respect to the centre of the bore to which the countersink is to be applied.
 13. A magazine for an airgun comprising a housing (2) and a magazine rotor (3) rotatably mounted therein, the magazine rotor (3) including a plurality of bores (7) therethrough, each bore forming a chamber for receiving an airgun pellet, wherein at least one of the chambers includes a resilient member (42) for retaining a pellet in the chamber.
 14. A magazine according to claim 13, in which each chamber comprises an internal wall, a first open end and an opposed second open end, wherein the resilient member extends from the internal wall into the chamber.
 15. A magazine according to claim 13 or claim 14, in which the magazine rotor includes an annular groove (40), the annular groove extending partially into each chamber (7), wherein the resilient member comprises a resilient ring (42), such as an O-ring, mounted in the annular groove (40).





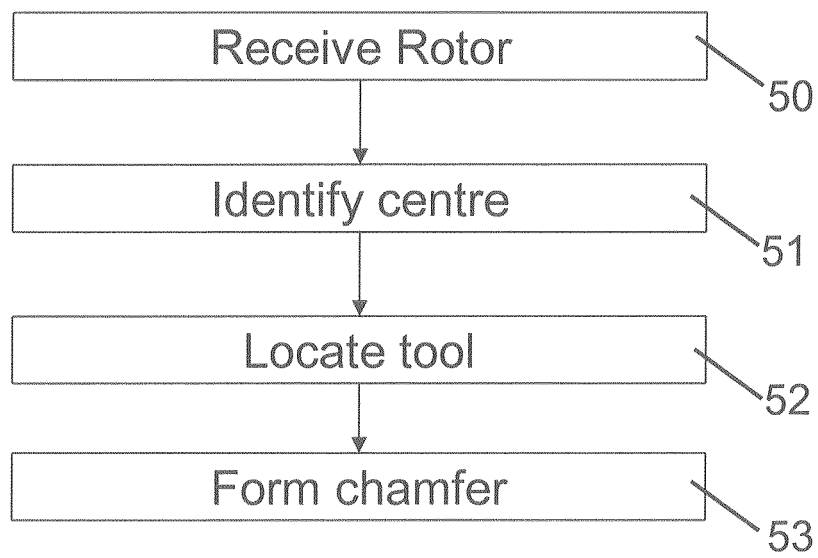


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0341090 A [0003]